

LONG POINT REGION CONSERVATION AUTHORITY

Reference Manual

DETERMINATION OF REGULATION LIMITS

November 2005

Long Point Region Conservation Authority

Determination of Regulation Limits

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1.0 Introduction

The Long Point Region Conservation Authority (LPRCA) is currently developing new Regulation Limits for riverine, waterfront, and wetland systems in the LPRCA watershed, based on the new Generic Regulation made under Section 28 (1) of the Conservation Authorities Act. These limits will be used to map all hazard areas within the watershed and will ultimately form the basis for Regulation for Development, Interference with Wetlands and Alterations to Shorelines and Watercourses (Ontario Regulation 97/04).

2.0 General Objectives

The Long Point Region Conservation Authority has established objectives which form the basis of the decision making process associated with regulation implementation. These objectives include, but are not necessarily limited to, an Authority program designed to:

- prevent loss of life,
- minimize property damage and social disruption
- reduce public and private expenditure for emergency operation, evacuation, restoration and protection measures
- *minimize the hazards and unnecessary development of riverine flood plains and flood and erosion susceptible shoreline areas which in future years may require expensive protection measures*
- regulate development which, singularly or collectively, impact upon existing flood levels and increasing potential risks to upstream and downstream landowners
- control interference with natural storage area such as wetlands
- encourage the conservation of land through the control of construction and placement of fill on existing or potentially unstable valley slopes or shoreline bluffs
- reduce soil erosion and sedimentation from development activity

3.0 Study Area

The study area (Figure 1) is comprised of the area within the Long Point Region Conservation Authority. More specifically, all or portions of Norfolk County, Haldimand County, County of Brant, County of Oxford, Municipality of Bayham and the Township of Malahide. More specifically, this area includes all lands that drain into Lake Erie between the westerly boundary of the Municipality of Bayham and the westerly boundary of the Township of South Cayuga. In addition, the LPRCA jurisdiction extends 5 km off shore, into Lake Erie, from the most westerly boundary continuing parallel to the shoreline to a point 5 km off the easternmost extremity of Long Point; thence in a straight line to a point 5 km perpendicular from the south-westerly boundary of the former Township of South Cayuga.

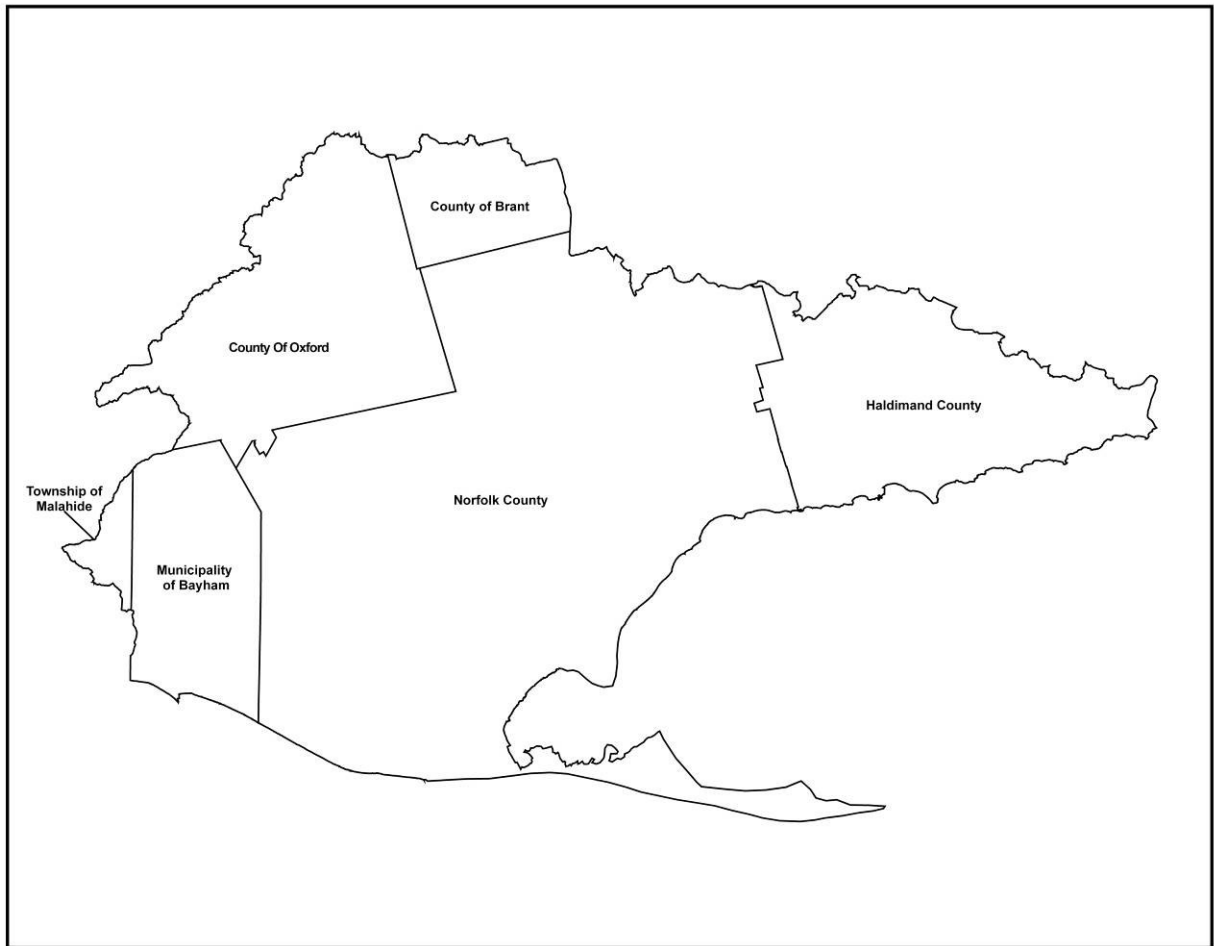


Figure 1

4.0 Riverine Hazards

Potential hazards associated with rivers, streams and their valleylands include flooding, stream bank and valley erosion and the erosion associated with meandering rivers and streams. The following outlined the methods that have been implemented to establish the boundaries of the hazardous lands associated with river and streams.

4.1 RIVERINE FLOODING HAZARD LIMIT

The *Riverine Flooding Hazard Limit* is generally based on 100-Year return period storm, where the drainage area is greater than 125 hectares at that location. The 100-Year floodlines are based on a storm that statistically occurs once every one hundred years. At the request of our watershed municipalities, the *Riverine Flooding Hazard Limit* for the LPRCA watershed is based on 100-Year return period storm flood event. This standard for *Riverine Flooding Hazard Limit* has previously received Minister's approval, 1987.

Engineered flood plain mapping is available for portions of the LPRCA watershed. The following figure illustrates the existing engineered mapping within the LPRCA watershed and this has been used in determining the Riverine Flooding Hazard Limit at those locations.

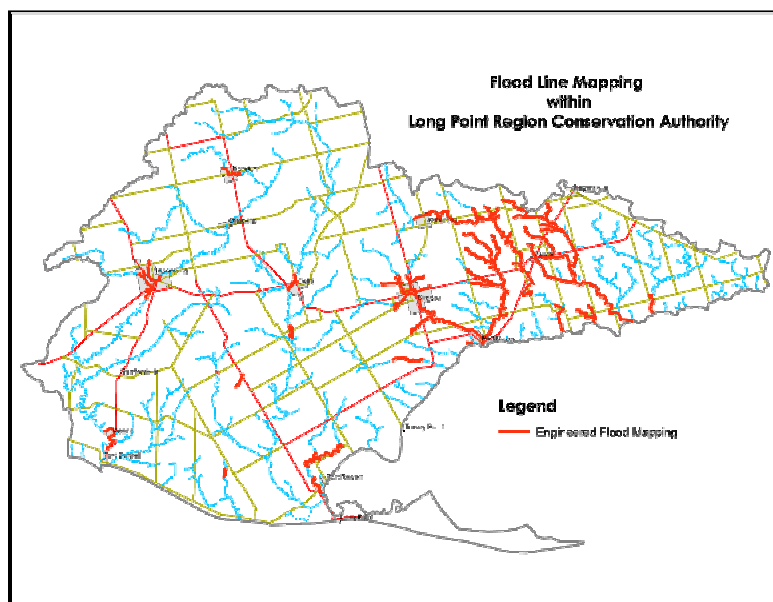


Figure 2

In areas where no engineered flood plain mapping exists, the flood plain was estimated using the best available information including field investigation, mapping and aerial photography.

4.2 RIVERINE EROSION HAZARD LIMIT - CONFINED SYSTEMS

The Erosion Hazard Limit for a riverine system consists of the valley Top of Slope and where necessary, the Toe Erosion Allowance, and the Stable Slope Allowance for a confined riverine system. A confined system is identified by a clearly visible valley (notable break in slope) shown on the mapping used within this project. The mapping used for contour information include 1:10 000 OBM mapping and 1:2 000 where available.

Georeferenced ortho photography and contour information derived from the DEM have been used to check watercourse location and regulation limits.

4.2.1 Valley Top of Slope – Confined Riverine Systems

The Valley Top of Slope is the break in slope point between the valley side slope and the tableland, and should be discernable from the contour line information.

4.2.2 Stream Erosion – Confined Riverine Systems

Stream bank erosion is an important cause of valley slope instability and is ultimately responsible for the presence of a valley. Stream erosion directly at the toe of a valley slope can steepen and undercut the slope, leading to the eventual failure of the bank. The *Toe Erosion Allowance* has been implemented to buffer development from the hazardous effects of toe erosion, and also to buffer the natural river processes from the influences of development. This allowance is based on a distance of 15 metres between the edge of a river system, and the toe of its confining valley wall.

4.2.3 Slope Stability – Confined Riverine Systems

Slopes are also naturally subject to movement and failure. The *Stable Slope Allowance* has been implemented to buffer development from the hazards of slope instability, and also to prevent the influence of development on the rate of slope movement. This allowance is based on an assumed stable slope gradient of 3 horizontal units to 1 vertical unit (3:1). For slopes at steeper gradients, the allowance is equal to the distance between the actual valley top of slope and the point at which a slope at a 3:1 gradient, rising from the same toe position, would intersect the ground surface.

4.3 RIVERINE EROSION HAZARD LIMIT - UNCONFINED SYSTEMS

The Erosion Hazard Limit for unconfined systems consists of the meander belt allowance. Unconfined systems occur where a watercourse is not contained within a clearly visible valley section.

4.3.1 Meander Belt – Unconfined Systems

In unconfined systems, the watercourse is not contained within a visible valley, and the flow of water is free to shift across the shallower land. Although toe erosion and slope stability are not deemed potential hazards, consideration for the meandering tendencies of the system must be provided. The *Meander Belt Allowance* provides a limit to development within the areas where the river system is likely to shift. This allowance is based on twenty (20) times the bankfull channel width.

The meander belt has been applied for many of the 1st and 2nd order streams in the watershed headwaters, where there is no apparent valley, streams are small, and sinuosity is low. In these situations, the stream width is estimated as 1.5 metres, and the meander belt is created as an offset from the watercourse feature on the base map. This process eliminates the need to establish a meander belt axis, and provides a reasonable meander belt allowance.

Where on-line ponds are located in unconfined systems, the meander belt width is increased by the width of the open water in the pond.

4.4 RIVERINE HAZARD LIMIT

The Erosion Hazard Limit (developed for either an unconfined or confined system) and the Flood Hazard Limit are applied in combination to every riverine system in the watershed. The greatest extent of these two limits is the Riverine Hazard Limit.

5.0 Shoreline Hazards

The coast or shoreline refers to the furthest landward limit bordering a large body of water. For the LPRCA watershed, Lake Erie forms the only shoreline along the watershed’s southern edge.

The Flooding and Erosion Hazard Limits for the shorelines of the Great Lakes have been established in order to regulate development in areas susceptible to periodic flooding and/or erosion concerns. The Shoreline Hazard Limit is taken to be the greater of the Flooding and Erosion Hazard Limits.

5.1 SHORELINE FLOODING HAZARDS

The Flooding Hazard Limit is based on the 100 Year Flood Elevation plus a 15 metre allowance for wave uprush. The 100 year flood levels for Lake Erie were determined by calculating the probability of all possible combinations of the entire range of monthly mean lake levels and winds setups which could combine to result in a peak instantaneous stillwater level having a total probability of being equalled or exceeded 1% any year. The 100 year flood elevation is based on information obtained from Table A.1 100 Year Peak Instantaneous Water Levels, “Great Lakes System Flood Levels and Water Related Hazards”, Ministry of Natural Resources, February 1989.

Table 1 : 100 Year Flood Limits for the Long Point Region Watershed

SHORELINE REACH	100 YEAR FLOOD LIMIT (M IGLD)
E-10 Port Burwell	175.7
E-11 Hemlock	175.8
E-12 Clear Creek	175.9
E-13 Erie View	176.1
E-14 Long Point Park	176.3
E-15 Long Point Central	176.5
E-16 Long Point East	176.6
E-17 Long Point Bay	176.3
E-18 Nanticoke	176.4
E-19 Selkirk	176.5

As part of the “Long Point Region Conservation Authority - Shoreline Management Plan”, the 100 Year Flood Elevation was mapped based on the calculated 100 Year Flood Limit, as a line landward.

5.2 SHORELINE EROSION HAZARD

Shoreline erosion is an important cause of slope instability, and is a potential hazard to waterfront development. The *Erosion Hazard Limit* for waterfront systems is applied to buffer development from the hazardous effects of shoreline erosion, and also to buffer the natural coastal processes from the influences of development.

5.2.1 Bluffs

The Erosion Hazard Limit for the shoreline was based on the following:

- The 100 year erosion limit, representing the estimated location of the shoreline 100 years from now. The mapping is based on comparison of aerial photography from 1956 to 2002 or 1988 depending on the availability of the photography. The recession rate was then multiplied by 100 plus an allowance for the year of the aerial photography or,
- In the absence of photographic evidence, the erosion allowance was determined to be 30 metres landward from the top of bank or first landward break in slope,
- a setback distance for slope stability (based on an assumed stable slope gradient of 3 horizontal units to 1 vertical unit - 3:1) was added

5.2.2 Beaches

Beaches must be analyzed differently from bluffs due to their dynamic nature - beach erosion is also reversible. The dynamic beach hazard for the Long Point Region Conservation Authority shoreline is based on the aggregate of the 100-year flood level, plus a 15 metre allowance for wave uprush plus a 30 metre dynamic beach allowance.

5.3 SHORELINE HAZARD LIMIT

The Erosion Hazard Limit and the Flood Hazard Limit are applied in combination to every shoreline system in the watershed. The greatest extent of these two limits is the Shoreline Hazard Limit. It should be noted that the shoreline hazard limit also extends lakeward to the furthest offshore extent of the Authority's jurisdiction.

6.0 Wetlands and Wetland Complexes

6.1 WETLANDS

Wetlands play an important role in the hydrology of watersheds, and therefore are also important features in flood plain management. From a natural hazard perspective, wetlands retain surface water and may release stored water to streams over periods of time. The attenuation of drainage in wetlands is a function that will influence the shaping of stormwater flow and flooding.

Because of the role of wetlands in flood plain management, the intent of mapping and regulating these features is to prevent effects to natural flood conditions through the loss of wetlands. It should be noted that compliance with this regulation does not exempt applicants from having regard for local by-laws, Municipal and Regional Official Plans, or the Provincial Policy Statements.

6.1.1 Wetland Mapping

Wetland mapping consists of evaluated wetlands derived from boundaries provided by the Ontario Ministry of Natural Resources. The evaluated wetlands from OMNR are "open files", meaning that boundaries can be adjusted based on new information from time to time. Newly evaluated wetlands may also be added to the wetland dataset.

6.1.2 Wetland Complexes

For the purpose of the regulation, wetland complex boundaries are not used. Wetlands will be protected from indirect impacts through the establishment of an "other area" around all wetlands as described in section 7.2.

7.0 Allowances, Other Areas, and Regulation Limits

7.1 ALLOWANCES

The Generic Regulation describes the use of an allowance that may be applied to all riverine and shoreline Hazard Limits. The allowance is for the purpose of maintaining sufficient access for emergencies, maintenance, and construction activities. This allowance is analogous to a factor of safety, providing protection against unforeseen conditions that may adversely affect the land adjacent to a natural hazard area. After combining the Shoreline Hazard Limit and Riverine Hazard Limit, and selecting the greater limit where the two Hazard Limits overlap, a 15 metre allowance is applied to the Hazard Limit.

7.2 OTHER AREAS

Wetlands can be affected by development where the development is outside of the wetland boundary but within the adjacent lands. These lands are known as *Areas of Interference*. The width of an Areas of Interference could be different for each application, and requires site by site assessment. Provincially Significant Wetlands are afforded a 120 metre setback through the Planning Act process.

For consistency, and to ensure wetland protection, LPRCA has considered the Area of Interference to include all land within 120 metres of all provincially significant wetlands and all land within 30 metres of all locally significant wetlands. The Areas of Interference will be included in the LPRCA regulation under Section 2(1)(e), as an "Other Area". This will allow LPRCA to review each application for development on land adjacent to wetlands through the permit process.

7.3 REGULATION LIMITS

The Regulation Limit is mapped as the greatest extent of the:

- Riverine Hazard Limit, and
- Shoreline Hazard Limit, and
- A 15 metre Allowance on all Riverine, and Shoreline Hazards
- wetland boundary, and
- areas of interference (30 or 120 metres) adjacent to all wetlands.

The greatest extent of all features identified above is the Regulation Limit provided on the LPRCA Regulation Limit mapping.

8.0 Definitions

The following definitions are intended to provide a clearer understanding of the basis by which these terms of reference have been written. All definitions have been obtained through accepted sources, as outlined in Section 8.0 – References.

Accepted engineering principles:

The current coastal, geotechnical, and hydraulic engineering principles, methods, and procedures that would be judged by a peer group of qualified engineers (by virtue of their training and experience) as being reasonable for the scale and type of project being considered, the sensitivity of the location, and the potential threats to life and property.

Access (ingress/egress):

Standards and procedures currently applied in engineering practice associated with providing safe passage for vehicles and people to and from a shoreline or river-side property during an emergency situation as a result of flooding, other water related hazards, the failure of floodproofing and/or protection works, and/or erosion that have been reviewed and approved by the Conservation Authority and/or the Ministry of Natural Resources.

Bankfull discharge:

The formative flow of water that characterizes the morphology of a fluvial channel. In a single channel stream, “bankfull” is the discharge, which just fills the channel without flowing onto the flood plain.

Confined System:

A riverine system where the physical presence of a valley corridor containing the system is visibly discernible. Also “well-defined system”.

Development:

Development means:

- a) The construction, reconstruction, erection, or placing of a building or structure of any kind;
- b) Any change to a building or structure that would have the effect of altering the use or potential use of the building or structure, increasing the size of the building or structure, or increasing the number of dwelling units in the building or structure;
- c) Site grading; or
- d) The temporary or permanent placing, dumping or removal of any material, originating on the site or elsewhere.

Drainage area:

For a point, the area that contributes runoff to that point.

Fetch:

The overwater length across which the wind blows.

Fill:

Any material used or capable of being used to raise, lower, or in any way affect the contours of the ground, whether on a permanent or temporary basis, and whether it originated on the site or elsewhere.

Hazardous land:

Hazardous land means land that could be unsafe for development because of naturally occurring processes associated with flooding, erosion, dynamic beaches, or unstable soil or bedrock .

Protection works:

Refers to structural or non-structural works, which are intended to appropriately address damages caused by flooding, erosion, and/or other water related hazards.

Slope crest:

The highest point on a slope at which the gradient becomes shallow enough to be used for access. Also "top of slope".

Slope toe:

The lowest point on a slope, where the surface gradient changes from relatively shallow to relatively steep.

Unconfined system:

A river or stream system where there is no discernible valley slope or bank that can be detected from the surrounding landscape. Also "ill-defined system".

Watercourse:

Watercourse means an identifiable depression in the ground in which a flow of water regularly or continuously occurs.

Wetland:

Wetland means land that

- a) is seasonally or permanently covered by shallow water, or has a water table close to or at its surface;
- b) directly contributes to the hydrological function of a watershed through connection with a surface watercourse;
- c) has hydric soils, the formation of which has been caused by the presence of abundant water; and,
- d) has vegetation dominated by hydrophytic plants or water tolerant plants, the dominance of which has been favoured by the presence of abundant water.

But does not include periodically soaked or wet land that is used for agricultural purposes and no longer exhibits a wetland characteristic referred to in clause c) or d)

9.0 References

1. Conservation Authorities Act (Revised Statutes of Ontario, 1990, Chapter C.27, as amended, Queens Printer March 29, 1999).
2. Ontario Ministry of Natural Resources; ***Great Lakes-St. Lawrence River System and large inland lakes - Technical Guides for flooding, erosion and dynamic beaches in support of the natural hazards policies statement***; 2001.
3. Ontario Ministry of Natural Resource; ***Great Lakes System Flood Levels and Water Related Hazards***; February 1989
4. Philipott Associates Coastal Engineers Limited; ***Long Point Region Conservation Authority Shoreline Management Plan***; 1989
5. ***Guidelines for Developing Schedules of Regulated Areas***, August 2003

Appendix A: Determination of Regulation Limits

Regulation Limits are the result of several components, each of which addresses a specific hazard. These include riverine flooding hazard limits, riverine erosion hazard limits, shoreline flooding limits, shoreline erosion limits, wetlands limits, allowances, and "other areas". Each of these components are identified and defined individually. The final Regulation Limit for each system is taken as the greater of the applicable hazard limits. The following identifies the steps taken by LPRCA staff to develop the regulation mapping:

1) Riverine Systems

Identify the valley Top-of-Slope. The Top-of-Slope is the break in slope point between the valley side slope and the tableland, and should be discernable from the contour line information. In agricultural area, the limit of tree line or fence lines is also indicators of the Top-of-Slope.

Identify the valley Toe-of-Slope. The Toe-of-Slope is the break in slope point between the valley floor and the valley side slope, and should be discernable from the contour line information.

Identify portions of steep valley slope. A greater contour density can identify steep slopes. At these sites, calculate the slope from the Valley Toe-of-Slope to the Valley Top-of-Slope by measuring the horizontal distance, and calculating the difference between the Valley Toe-of-Slope elevation and the Valley Top-of-Slope elevation. If the ratio of horizontal distance: elevation difference is more steep than 3:1, multiply the elevation difference by 3, and identify a Stable Slope

Identify portions of the valley system where the creek bank is close to the valley side slope (wherever the creek bank and the valley Toe-of-Slope are within 15 metres or less). At these sites calculate the difference between 15 metres and the actual distance between the creek bank and the valley Toe-of-Slope. Apply this allowance beyond the valley Top-of-Bank. If a Stable Slope Allowance has already been calculated at the site, apply the Toe Erosion Allowance beyond the Stable Slope Allowance.

Where a valley Top-of-Slope cannot be discerned, the valley is considered Unconfined, and a Meander Belt is applied in place of the features identified in steps a) through d). Calculate the meander belt width as 20 times the width of the bank full channel. Where the channel width cannot be measured or is not known, assume a minimum width of 1.5 metres. Although the meander belt should be centered on the meander axis, estimation can be made by setting the meander belt as an offset from the watercourse layer.

Select the Riverine Erosion Hazard Limit as the outer most line of all the combined features identified above.

Add the Riverine Floodline Hazard Limit. This line has been developed from the various flood plain mapping sources.

Select the Riverine Hazard Limit as the outer most line of the Erosion and Floodline Hazard Limits.

2) Shoreline Systems

Add the 100 year Floodline and Shoreline Erosion Limit from the mapping sources. The most landward extent of these lines is the Shoreline Hazard Limit.

3) Combine Shoreline and Riverine Hazard Limits

- Overlay the Shoreline and Riverine Hazard limits, and select the outermost limit.
- Apply an Allowance of 15 metres outward from the combined Shoreline and Riverine Hazard Limit. This is the portion of the Regulation Limit for Riverine and Shoreline Systems.

4) Wetland Systems

- Add the wetland layers from Ministry of Natural Resources digital wetland layers.
- Apply an "Area of Interference" of 120 metres beyond the Wetland Limit of provincially significant wetland.
- Apply an "Area of Interference" of 30 metres beyond the Wetland Limit of all other wetlands.

5) Regulation Limit

Combine the Regulation Limit for Riverine and Shoreline Systems and the "Other Area" Limit. The outer most limit of these features is the LPRCA Regulation Limit. The Regulation Limit is the greatest extent of:

- Riverine Hazard Limit, and
- Shoreline Hazard Limit, and
- An allowance of 15 metres on all Riverine and Shoreline Hazards, and
- Wetland boundary, and
- "Areas of Interference" within 120 or 30 metres of all wetlands

6) Base Mapping.

The LPRCA Regulation Limit is shown on the latest available georeferenced ortho photography or Land Sat 7 Imagery depending on availability. The mapping will be published at a scale of 1:10,000, and will include the Regulation Limit Line, roadway labels and watercourses, and a full legend. The mapping will be available on individual sheets. Digital version of the mapping will be made available as well.